FACING TILE INSTITUTE | MAY 1968 | 4 | UNIT MASONRY clay facing brick

specifications
standards
requirements
test methods
ratings

New, Revised & Simplified for

CERAMIC
GLAZED
FACING
BRICK

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Compliments of

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SPECIFICATIONS FOR CERAMIC GLAZED FACING BRICK
(Solid Masonry Units Made From Clay Or Shale)
FTI DESIGNATION GFB1-68

1. SCOPE

These specifications cover ceramic glazed facing brick made from clay, shale, fire clay, or mixtures thereof and burned. Three types and two qualities of brick in one grade are covered. Brick covered by these specifications shall be understood to mean solid masonry units.

NOTE: Brick or solid masonry unit (multicored or uncored) is a masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is 75 per cent or more of its gross cross-sectional area measured in the same plane. Such brick have a finish consisting of a high temperature fired ceramic glaze fused to the body, making them inseparable, and meeting the following specifications and test requirements.

2. GRADE

Grade EW — Glazed facing brick intended for use where a high and uniform degree of resistance to frost action and disintegration by weathering is desired. (See Appendix II)

3. TYPES

Three types of facing brick are covered:

Type GBX — Brick for general use in exposed exterior and interior masonry walls and partitions where a high degree of mechanical perfection, narrow color range, and minimum permissible variation in size are required.

Type GBS — Brick for general use in exposed exterior and interior masonry walls and partitions where wider color ranges and greater variation in size are permitted than are specified for Type GBX.

Type GBA — Brick for general use in exposed exterior and interior masonry walls and partitions manufactured and selected to produce characteristic architectural effects resulting from non-uniformity in size, color, and texture of the individual units.

NOTE: For design practice and data see Appendix II.

4. QUALITIES

Two qualities are available, and shall meet the requirements for durability (grade EW), and shall vary in appearance only:

Select Quality — Highest quality brick for normal usage, and meeting all the applicable requirements contained in this specification.

Standard Quality* — A mixture of Select and off quality brick where a lesser degree of quality is acceptable (a minimum of 80 per cent Select Quality and a maximum of 20 per cent off quality). The glaze shall be free from chips (except as noted in Table III), blisters, crawling or other imperfections detracting from the appearance of the finished wall when viewed at a distance of 20 feet at right angles from the wall, except that not more than 20 per cent of the units may have slight mechanical or glaze imperfections.

*Subject to manufacturers' accumulation.

5. PHYSICAL PROPERTIES

(a) Durability — Brick shall conform to the appropriate physical requirements of Table I for durability determinations unless they meet the appropriate requirements given in Table II.

NOTE 1: In Tables I and II, all three ranges of minimum brick compressive strength, each with its specific additional physical property requirements, represent brick of comparable and satisfactory Grade EW durability.

NOTE 2: For structural design purposes actual average and minimum compressive strength of a given brick shall be used, in accordance with the procedures of the recognized and applicable building codes to determine design working stresses.

TABLE I

Minimum Compressive Strength (brick flatwise) psi (gross area)		24 hr. Cold Water Soak Absorpiton, %		Max. Water Absorption by 5 hr. Boil, %		Max. Saturation Coefficient*	
Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick
3000	2500	13.3	16	17%	20%	.78	.80

TABLE II

Minimum Compressive Strength (brick flatwise) psi (gross area)		24 hr. Cold Water Soak Absorption, %		Max. Water Absorption by 5 hr. Boil, %		Max. Saturation Coefficient*	
Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick	Av. of 5 brick	Ind. brick
6000	5000	6%	8%	N.R.	N.R.	N.R.	N.R.
9000	7500	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.

N.R. — No Requirement

*Saturation coefficient is the ratio of the 24 hr. cold water absorption to the 5-hr. boil absorption.

(b) Freeze and Thaw Testing — Glazed brick manufacturers, meeting all other requirements of these specifications, are also required to provide test data on similar brick made within the previous 12 months showing conformance with the freezing and thawing requirements of ASTM Designation C67-, showing that after 50 cycles there is no breakage and not greater than 0.5% loss in dry weight of any brick and no observable difference in the applied finish when viewed from a distance of 10 ft. under an illumination of not less than 50 foot candles, by an observer with normal vision.

(c) Strength — When brick for structural purposes are required having strengths greater than prescribed by these specifications, the purchaser shall specify the desired minimum compressive strength.

6. MATERIAL, WORKMANSHIP AND FINISH

(a) The brick shall be free of cracks or other defects that would interfere with the proper setting of the brick or impair the strength or permanence of the construction. The face or faces that will be exposed in place shall be free of chips that exceed the limits given in Table III. The limits apply to the types as specified. The aggregate length of chips shall not exceed 10 per cent of the perimeter of the face of the brick. The face or faces shall be free of other imperfections detracting from the appearance of a sample wall when viewed from a distance of 15 ft. for type GBX and a distance of 20 ft. for types GBS and GBA.

TABLE III

Maximum Permissible Extent of Chippage From The Edges and Corners of Finished Face or Faces Into The Surface

	Chippage in Inches	
	from Edge	from Corner
Type GBX	1/16	1/8
Type GBS (a)	1/8	3/16
Type GBS (b)	3/16	1/4
Type GBA (c)	As specified by the purchaser.	

(a) Smooth Texture is the unbroken natural die finish.

(b) Rough texture is the finish produced when the face is sanded, combed, scratched, or scarified or the die skin on the face is entirely broken by mechanical means such as wire-cutting or wire-brushing.

(c) Glaze crazing due to the manufacturing process shall be permitted if purchaser desires for esthetic reasons, and approves a sample. If so approved, the autoclaving test shall be waived, and ink staining of the body through craze cracks shall also be permitted.

7. SIZE VARIATIONS

(a) Size - The size of brick shall be as specified by the purchaser (see subparagraph (c)). In a sample of 5 brick selected to include the extreme range of color and size of brick to be supplied, no brick shall depart from the specified size by more than the individual tolerance for the type specified as prescribed in Table IV. Tolerances on dimensions for type GBA shall be as specified by the purchaser.

TABLE IV

Tolerances on Dimensions

Specified Dimension, in.	Maximum Permissible Variation from Specified Dimension, plus or minus, in.	
	Type GBX	Type GBS
3 and under	1/16	3/32
Over 3 to 4, incl.	3/32	2/16
Over 4 to 6, incl.	2/16	3/16
Over 6 to 8, incl.	2/16	4/16
Over 8 to 12, incl.	3/16	5/16
Over 12 to 16, incl.	4/16	3/8

(b) Warpage — Tolerances for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line, respectively, shall not exceed the maximum for the type specified as prescribed in Table V. Tolerances on distortion for type GBA shall be as specified by the purchaser.

TABLE V

Tolerances on Distortion

Maximum Face Dimension, in.	Maximum Permissible Distortion, in.	
	Type GBX	Type GBS
8 and under	1/16	3/32
Over 8 to 12, incl.	3/32	1/8
Over 12 to 16, incl.	1/8	5/32

(c) Size Designation — Sizes of brick shall be as shown in Table VI.

TABLE VI

Series	Height inches	Width inches	Length inches
Standard (S)	2-1/4	3-3/4	8
Modular (4S)	2-1/4	3-5/8	7-5/8
	2-3/8	3-3/4	7-3/4
Oversize (J)	2-3/4	3-3/4	8
Norman (6S)	2-1/4	3-5/8	11-5/8
	2-1/4	3-3/4	11-3/4
Oversize Norman (6J)	2-3/4	3-5/8	11-5/8
	2-3/4	3-3/4	11-3/4

NOTE: Additional sizes may be available from individual manufacturers, which otherwise will comply with these specifications.

8. CORING AND FROGGING

(a) Coring — Unless otherwise specified, brick may or may not be cored at the option of the manufacturer. The net cross-sectional area of cored brick in any plane parallel to the bearing surface shall be at least 75 per cent of the gross cross-sectional area measured in the same plane. No part of any hole shall be less than 3/4 in. from any edge of the brick. Individual holes shall not exceed 1-1/2 sq. in. in area, except that larger openings are permitted in special units or shapes.

(b) Frogging — Unless otherwise specified, one bearing surface of each brick may have frogs (recesses) not exceeding 3/8 in. in depth, except that in brick containing deep frogs, any cross-section through the frogs parallel to the bearing surface shall conform to the requirements of paragraph (a). No part of the frog shall be less than 3/4 in. from any edge of the brick.

9. PROPERTIES OF FINISH

(a) Imperviousness — After the imperviousness test, no stain that can be seen from a distance of 5 ft. shall remain on or beneath the surface, except a slight discoloration in the depressions on matte, stippled, or mottled finishes.

(b) Opacity — Where opacity of finish is desired and so specified, discoloration of the body shall not be visible through the glaze in the opacity test. Clear ceramic glazes and special decorative glazes shall not be required to meet this requirement.

(c) Resistance to Fading — The color of the glaze shall not change in the chemical resistance test. Finishes of metallic or special decorative glazes shall not be required to meet this requirement.

(d) Resistanct to Crazing — The glaze shall not craze, spall, or crack when subjected to one cycle of autoclaving in the crazing test, except as noted in 6(b). (See 14(d).)

(e) Flame Spread, Fuel Contribution, and Smoke Density — Body and finish must rate "non-combustible". When tested in accordance with the provisions of ASTM Designation E84-, "Standard Method of Test for Surface Burning Characteristics of Building Materials", Glazed Facing Brick shall measure 0 Flame Spread, 0 Fuel Contribution, and 0 Smoke Density. This test method is similar to that specified in ASA 2.5, NFPA No. 255, UL No. 723, and UBC No. 42-1.

(f) Toxic Fumes* — Toxic fumes shall not be released from the body or glaze finish when tested under ASTM E84- (Surface Burning Characteristics of Building Materials).

*See National Fire Protection Association Handbook, Chapter 6-67, paragraph B "Toxicity of Burning Plastics".

10. COLOR AND TEXTURE

The textures shall be smooth, mottled, speckled, stippled or as otherwise specified and the color of the finished surface shall be indicated by a sample consisting of five brick.

11. SAMPLING

For purposes of tests, 10 brick that are representative of the specified product shall be selected by a competent person appointed by the purchaser, the place or places of selection to be designated when the purchase order is placed. The sample or samples shall include specimens representative of the complete range of colors and sizes of the brick supplied or to be supplied. The manufacturer or the seller shall furnish specimens for tests without charge.

12. INSPECTION AND TESTING

The purchaser or his authorized representative shall be accorded opportunity for sampling and inspecting units at the place of manufacture, prior to shipment. At least ten days from the time of sampling should be allowed for completion of the tests, except in the case of the Freeze-Thaw test for which not less than four months must be allowed.

13. COST OF INSPECTION AND TESTS

Unless otherwise specified in the purchase order, the cost of applicable tests shall be borne as follows:

(a) The expense of the inspection shall be borne by the purchaser.

(b) If the results of the tests show that the brick do not conform to the requirements of these specifications, the cost shall be borne by the seller.

(c) If the results of the tests show that the brick do conform to the requirements of these specifications, the cost shall be borne by the purchaser.

14. METHODS OF TEST

(a) Compressive Strength Test — Compressive strength tests shall be made on five specimens in accordance with the Standard Methods of Sampling and Testing Brick (ASTM Designation C67-). The specimens used in the crazing test (paragraph (d)) shall not be used in the compressive strength test.

(b) Imperviousness Test — Permanent blue-black fountain pen ink shall be applied liberally to the glazed surface of five dry specimens and allowed to remain for five minutes. The surface shall then be washed with a wet cloth and running water, and examined from a distance of five ft. for staining of the finish on or beneath the surface.

(c) Chemical Resistance Test — An end portion of two whole specimens shall be submerged with the glazed surface exposed to a minimum depth of 1-1/2 in. in a 10 per cent solution of HC1 for 3 hrs. The opposite end portions of the glazed surfaces of the same specimens shall then be similarly submerged in a 10 per cent solution of KOH for 3 hrs. These solutions shall be maintained at a temperature of 60° to 80° F. (15° to 27° C.). The finishes shall then be rinsed, dried, and examined for changes of texture and color.

NOTE: A 10 per cent solution of HC1 is prepared by volume by using 10 per cent concentrated HC1 which is 12 N or 37.0 per cent. A 10 per cent solution of KOH is prepared by weight using, for example, 10 g of KOH diluted to 100 g solution. Distilled water is used and fresh solutions should be made for each test set up.

(d) Autoclave Crazing Test — The crazing test shall be made on three whole dry brick previously tested for imperviousness of finish (paragraph (b)). Specimens subjected to the chemical resistance test (paragraph (c)) shall not be used. The autoclave shall have sufficient capacity to contain all the units of the same texture, color, and size. The apparatus shall be equipped with a safety valve, blowoff valve, thermometer, and pressure gauge accurate within 2 per cent of the scale range; and a heater or other means of sufficient capacity to insure constant steam pressure within the autoclave (Caution, see Appendix I). The specimens shall be placed loosely above the water in the autoclave at room temperature. After fastening the autoclave head in place, the water in the bottom shall be heated from an external source. The blowoff valve shall be kept open until steam begins to escape, thereby expelling most of the air. After closing the blowoff valve, the water shall be kept boiling and the steam pressure increased at a uniform rate until it reaches 150 psi within a period of not less than 60 min. nor more than 90 min. Sufficient heat shall be applied to maintain a constant steam pressure of 150 $\pm$ 5 psi for an additional hour. The heater shall then be shut off and the steam pressure released slowly in not less than 30 min. by opening the blowoff valve. The autoclave head shall be loosened, but not removed, and the specimens permitted to cool gradually to room temperature in a period not less than 3 hrs. The specimens shall then be removed and permanent blue-black fountain pen ink rubbed upon the glazed surfaces to aid in the detection and examination of failures. Neither the glaze nor the body shall craze, spall, crack, discolor or fade.

(e) Opacity Test — The opacity test shall be conducted on three dry specimens by applying permanent blue-black fountain pen ink liberally to the body along a 2-in. length of the edge of the finished surface. After

5 mins., the finish shall be examined for opacity. When the same three specimens are to be subjected to both opacity and crazing tests (paragraph (d)), the opacity test shall be made first.

(f) Absorption Test — The absorption test shall be made on five whole brick or on five pieces containing not less than 8 square inches of glazed surface each, and of the thickness of the body, cut or sawed from five specimens. When the same specimens are to be subjected to the absorption and crazing tests, the absorption test shall be made first. The absorption test shall be made in accordance with the Standard Methods of Sampling and Testing Brick (ASTM Designation C67-).

APPENDIX I
SAFETY PRECAUTIONS FOR
AUTOCLAVE EQUIPMENT AND OPERATION

The autoclave pressure gauge should have a range from zero to 600 psi, and should be tested regularly.

If an automatic control is used, it should be maintained in proper working order.

The safety valve should be tested regularly and set to relieve the pressure at about 20 psi above the 155 psi maximum specified in Section 14(d). The discharge should be directed away from the operator.

During the test a thermometer should always be used as a safety pressure check.

Precautions should be taken at all times for unexpected developments. The operator should be completely alert and thoroughly familiar with all operations.

Suitable gloves should be worn when loosening bolts and removing autoclave top at the completion of the test. The vent valve should be properly directed and the lid tilted so that escaping steam is discharged away from the operator.

It should be remembered that for many autoclave pressure gauges now in use, the return of the gauge hand to the initial test or starting point does not necessarily indicate zero pressure within the autoclave — there may still remain appreciable pressure.

A few drops of kerosene placed in the vent valve about once a week will aid in keeping the needle clean and in good working condition.

All additional safety precautions, as contained in the autoclave manufacturer's literature and specific operating instructions, should be carefully observed at all times.

APPENDIX II

As is true of all masonry walls, accepted design and construction principles should be followed to protect the wall from moisture penetration, such as permanent flashings and weepholes (where necessary) under copings, at roof-wall lines, under parapets, above wall openings, below sills, at foundation grade lines, etc. Damp-proof courses should be used at the base of all walls. Copings should have proper drips built in, or provided by flashing.

Vapor barriers should be installed, if interior of wall is subjected to excessive humidity conditions.

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Glazed brick are not recommended for copings, caps, or other horizontal surfaces.

Expansion joints should be provided to handle wall expansion or contraction of 3/4-inch per 100 feet of wall and should also be provided between 4 feet and 10 feet from any corner and where necessary, at columns, pilasters, and wall junctures. Such joints should be filled with non-hardening permanently elastic material designed to prevent water entry. Horizontal control joints and bond breaks should also be included where necessary.

Mortar shall be of Portland cement-lime types N, S, O, or M, of ASTM Designation C270-, as specified for job requirements. All head, bed and collar joints should be solidly filled except in cavity walls. Joints shall be well tooled with a plastic, glass or stainless steel implement. If suction of bed surface of brick is above 20 grams per minutes, then the brick should be wetted before laying.

Window and door jambs should be well caulked and maintained, with non-hardening permanently plastic caulking material.

Walls should be adequately reinforced if they are to be subjected to unusual loadings, or possible foundation settlements, etc., that might cause the masonry to crack, or if walls are of dissimilar masonry.

During construction all excess mortar should be carefully removed from the wall surface with a clean cloth daily as the work progresses. After installation is completed and mortar has thoroughly set, walls should be cleaned with soap and water or a suitable detergent solution and a fibre brush followed with a thorough rinsing with clear water. Lumps of mortar may be removed with sharpened wood paddles. Do not use metal scrapers, wire brushes, or abrasive powders.

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